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Forest and Range
Experiment Station

FOREST SERVICE
U.S.DEPARTMENT OF AGRICULTURE
P.O. BOX 245, BERKELEY, CALIFORNIA 94701

CONTROL OF CHAMISE REGROWTH WITH PHENOXY HERBICIDES

. . . affected by sprout age, date of application

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U.S.D.A. Forest Service
Research Note PSW-192
1969

ABSTRACT: A low-volume broadcast water-oil emulsion of 2,4-D or brushkiller was applied to 1-, 2-, and 3-year old chamise *(Adenostoma fasciculatum)* sprouts early, mid, and late in the spring growing season to determine the most effective spray date on different aged regrowth. The early date, at the beginning of May, was best for the older sprouts. Late May was best for the first-year sprouts, after most of them had emerged. Stage of floral development may be a good indicator of when to spray chamise in southern California.

RETRIEVAL TERMS: broadcast spraying; chaparral control; *Adenostoma fasciculatum;* 2,4-dichlorophenoxyacetic acid; brushkiller.

OXFORD: 441–414.12 2,4-dichlorophenoxyacetic acid:268.44:176.1 *Adenostoma fasciculatum.*

Low-volume, broadcast applications of 2,4-D will usually control chamise *(Adenostoma fasciculatum)* sprouts satisfactorily. Two annual applications will normally kill 90 percent or more of the plants. Experience indicates, however, that "correct timing" is essential for successful spraying. When herbicide is put on at the right time, when plants are in the right physiological condition, one application will often do the job. But what is not satisfactorily known is the best criterion on which to gauge the correct time to spray. Growing conditions, plant age, herbicide formulation, elevation, and many other factors must be considered when selecting a spray date.

In a test in southern California, different-aged chamise sprouts were broadcast sprayed at different times during the growing season with a water-oil emulsion of 2,4-D or brushkiller. Information was collected on the phenological development of chamise plants at each spray date. I found that the stage of flower development on mature plants may be a good guide as to the best time to spray, but this conclusion needs further testing.

METHODS

The test was made on three different chamise-covered areas on three different National Forests. Each area had been previously burned by wildfire in a different year *(table 1).* At the time of treatment in spring 1960, sprouts in the first, second, and third growing season were represented. Spraying was done in either early or late May or in late June *(table 2)* in an attempt to bracket the most effective spray date *(table 2; fig. 1).* Charred snags which remained after the fires were knocked down before spraying.

The spray mixture contained either 4 pounds acid equivalent (a.e.) of low volatile esters[1] of 2,4-D or a

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Table 1.–*Test areas in southern California on which chamise sprouts were treated by 2,4-D or brushkiller*

	Area and location	Elevation	Burned	Sprout age
		Feet		
I:	Saugus District, Angeles National Forest	3,300	October 1959	First season
II:	Trabuco District, Cleveland National Forest	2,000	December 1958	Second season
III:	Lytle Creek District, San Bernardino National Forest	3,300	August 1957	Third season

50-50 brushkiller mixture of 2 pounds a.e. each of 2,4-D and 2,4,5-T, 1 gallon of diesel oil, and 18 gallons of water applied at a volume of 20 gallons per acre. Spraying was done with a portable boom outfitted with six #80015 Tee-jet nozzles which treated an effective swath 10 feet wide.

The test plots were 15 feet wide and 100 feet long, and were arranged in a randomized block design with two replications at each area. Herbicide effect was determined on Area I in October 1960, with a partial recheck in May 1962; on Area II in September 1961; and on Area III in August 1961. Sampling was accomplished by recording the condition of all plants in a 4.4-foot-wide transect 100 feet long, which was located in the center of each plot. The percent of dead plants was calculated for each treatment; after arcsin transformation, an analysis of variance was made of the transformed data.

Table 2.–*Condition of chamise new growth and flowers at each spray date, by test area and growing season*

Test area	Spray date	Sprouts		
		Height	New growth	Flowers[1]
		EARLY MAY		
I	May 6	Emerging to 6 in.	0 to 6 in. long, succulent	Buds formed, not open
II	May 3	1 to 2 ft.	2 to 6 in. long, succulent	Buds formed, not open
III	May 2	2 to 4 ft.	3 to 6 in. long, succulent	Buds formed, not open
		LATE MAY		
I	June 3	1 to 10 in.	Growing, fairly succulent	Full bloom
II	May 25	Most 1 to 2 ft.	(no data)	Full bloom
III	May 26	2 to 4 ft.	Hardened	Part-to-full bloom
		LATE JUNE		
I	June 28	6 to 14 in.	Partly succulent	(no data)
II	June 23	1 to 2 ft. plus	Some new growth, 1 to 3 in., succulent	Flowering ended
III	June 29	2 to 4 ft. plus	Hardened	Flowering ended

[1]Refers to adjacent unburned mature plants except for the third-season plants which were in flower themselves.

Table 3.—*Dead first-, second-, and third-season sprouting plants after broadcast spraying with 2,4-D or brushkiller in early and late May, and in late June*

Test area and growing season		Herbicide	Dead plants, sprayed in . . .		
			Early May	Late May	Late June
			Percent		
I:	1st growing season	2,4-D	35	55	44
		Brushkiller	56	63	33
II:	2nd growing season	2,4-D	54	42	11
		Brushkiller	33	17	42
III:	3rd growing season	2,4-D	86	41	13
		Brushkiller	79	77	14

Herbicide formulation.—Neither 2,4-D or brushkiller showed any consistent trend in effectiveness *(table 3)*. A composite of all age groups *(fig. 2)* showed no significant advantage in using brushkiller. Pooling plants by age groups indicated that brushkiller was slightly but not significantly more effective on first- and third-season sprouts.

Under favorable spray conditions, a formulation of low-volatile esters of 2,4-D gave excellent sprout kill.[4] Little or no advantage was found by adding 2,4,5-T to the spray mixture;[8] however, Leonard and Carlson[9] reported that a brushkiller mixture of 2,4-D and 2,4,5-T gave greater kill when conditions were not optimum.

Although 2,4-D still seems to be the best bet for controlling chamise regrowth, additional work is needed to clarify the various other factors just discussed. The effect of herbicides on different aged sprouts should be tested at one location, and the same tests should be carried out for at least 3 years to account for yearly variations in growing conditions.

Notes

[1] Butoxy ethanol esters of 2,4-D and propylene glycol butyl ether esters of 2,4,5-T.

[2] Leonard, O. A., and Harvey, W. A. *Chemical control of woody plants.* Calif. Agr. Exp. Sta. Bull. 812. 26 p. 1965.

[3] Jones, Milton B., and Laude, Horton M. *Relationships between sprouting in chamise and the physiological condition of the plant.* J. Range Manage. 13(4): 210-214. 1960.

[4] Leonard, O. A. *Studies of factors affecting the control of chamise (Adenostoma fasciculatum) with herbicides.* Weeds 4(3): 241-254. 1956.

[5] U.S. Department of Commerce. *Climatological data.* California annual summary 1959 and 1960. Vols. 63, 64, No. 13. Weather Bureau. Published in 1960 and 1961.

[6] Hyder, D. N., and Sneva, F. A. *Spraying for big sagebrush in stands of bitterbrush.* Res. Prog. Rep. Western Weed Control Conf. p. 19-20. 1960.

[7] Plumb, T. R. *Three years of broadcast spraying chamise sprouts in southern California.* U.S. Forest Serv. Res. Note 197. Pacific SW. Forest & Range Exp. Sta., Berkeley, Calif. 9 p. 1962.

[8] Plumb, T. R., and Bentley, J. R. *Rate of broadcast 2,4-D spraying on second-year chamise sprouts.* U.S. Forest Serv. Res. Note 163. Pacific SW. Forest & Range Exp. Sta., Berkeley, Calif. 7 p. 1960.

[9] Leonard, O. A., and Carlson, C. E. *Control of chamise and brush seedlings by aircraft spraying.* Calif. Dep. Nat. Resources, Div. Forestry. 27 p. 1957.

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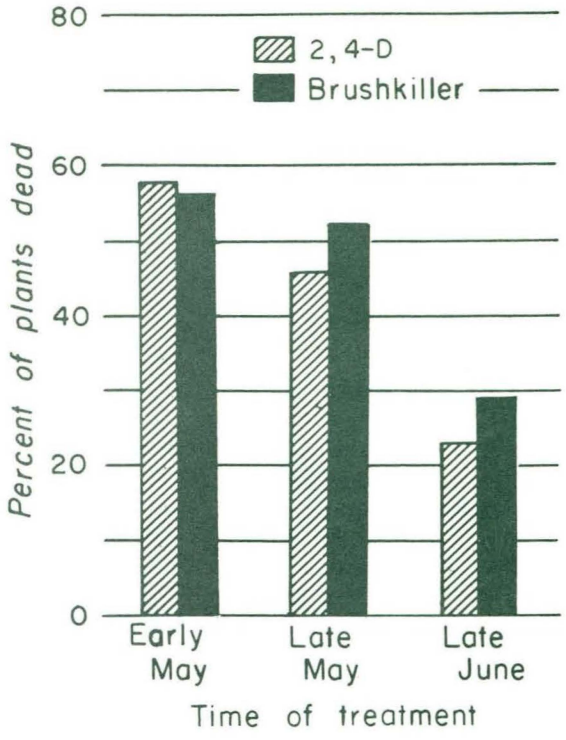

Figure 2.—*The herbicides 2,4-D and brushkiller failed to show any significant differences in effectiveness in killing chamise plants, whether applied in early and late May or in late June.*

scheduling herbicide spraying of sagebrush. But the use of floral development as a spray guide in southern California needs further testing. The possibility of rapid soil drying there may not be reflected by flowering.

Effect of age of regrowth.—Although the pooled results indicate that the early spray date was best, the different age groups showed highly significant differences *(fig. 3)*. Consequently, plant age must be considered when deciding a spray date. Leonard[4] reported that the most dependable chamise kill occurs when sprouts are sprayed the first spring after a fall or summer fire. In an earlier report, Plumb[7] noted that there was excellent kill of second-season plants on some areas when growing conditions were good and thorough spray plant coverage was obtained. But, second-season sprouts are not satisfactorily killed on most areas unless spraying is repeated the following year to kill survivors. Leonard[4] also reported that single applications on sprouts 2-years old were not effective.

Unexpectedly, the best kill obtained in this test was the average kill of 83 percent on the third-season sprouts sprayed in early May *(fig. 3)*, but the kill of the younger sprouts was considerably less than expected. The kill of third-season sprouts successively declined at the later dates; however, the kill from the late May spraying was as great as that obtained on any of the younger plants in the entire test.

The kill of second-season sprouts was considered poor. And as in the older sprouts, kill declined successively from the early to the late spray date. Although no specific reason is suggested for the unsatisfactory response of the second-season sprouts, poor results may have been due to the low rainfall. A different pattern of plant kill was obtained with the first-season sprouts. Greatest kill was obtained in late May. This finding is in line with past experience which indicated that spraying of first-year regrowth may be too early if it is done before all the sprouts have emerged—even though some of them are already 6 to 8 inches tall. Sprouts treated at the early spray date were twisted and partly dead by late May; by late June enough regrowth had developed that it was not obvious that the plants had been sprayed.

The results of this test tend to substantiate the generally accepted belief that the sprout's age is a factor that affects its response to herbicides. Apparently, second- or third-season sprouts can be sprayed more effectively earlier in the growing season than first-season sprouts.

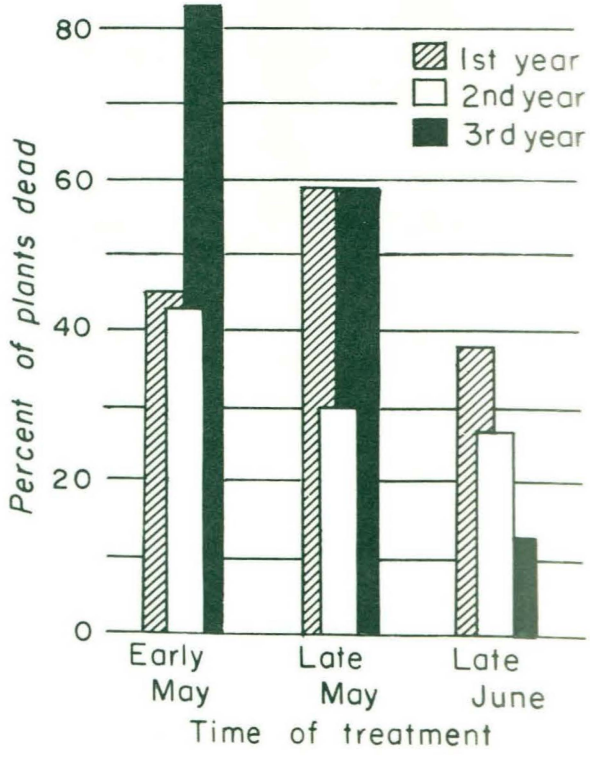

Figure 3.—*Percent kill of chamise sprouts treated with herbicides was highest in early May and lowest in late June.*

RESULTS AND DISCUSSION

The control of chamise regrowth in this test, in terms of plant kill, was generally unsatisfactory regardless of plant age or date of application, with the rather surprising exception of the 3-year sprouts treated in early May *(table 3)*. Spraying of first-year sprouts may best be delayed until almost all potential sprouts have emerged; in this test late May was the most effective date.

Date of application.–The phytotoxic effect of a systemic herbicide like 2,4-D is not the same in all seasons. Spraying is generally recommended for the period of active growth in spring, between March and June in southern California.[2] The best time to spray is near the end of the growing season before plant growth hardens. This timing assures that most sprouts have emerged, and it corresponds to the time when food reserves are at a minimum.[3]

In this test, timing was found to be statistically highly significant *(fig. 2)*. Slightly better kill was obtained when regrowth was sprayed in early May than in late May. Fewer plants were killed at the later date. But the interaction between date and sprout age was statistically very highly significant.

Woody plants need adequate soil moisture for shoot and root growth.[2] When soil moisture is reduced plants become less sensitive to 2,4-D.[4] Even seedlings which normally are highly susceptible to broadcast spraying during the active growing season may become resistant during summer. Although I did not measure soil moisture, rainfall records of four U.S. Weather Bureau recording stations near the test areas suggested that the average precipitation from January 1959 to June 1960 was only about 55 to 65 percent of normal.[5]

Most plants had some succulent growth at the early date *(table 2)*. New growth had hardened on third-season sprouts by the end of May, but the first-season sprouts were then still succulent and growing. And these plants were still partly succulent by the end of June.

Perhaps floral development in either mature plants near the spray area or the regrowth itself, if it is old enough, is a better indicator of plant condition since it seemed to be more consistent on each area and each spray date than degree of sprout succulence. And it was easy to identify a particular stage of development. At the early date, flower buds were formed, but few had opened. By late May, chamise was in full bloom, and by late June flowering had ended.

Floral development[6] or the condition of various herbaceous plants has been used as a guide for

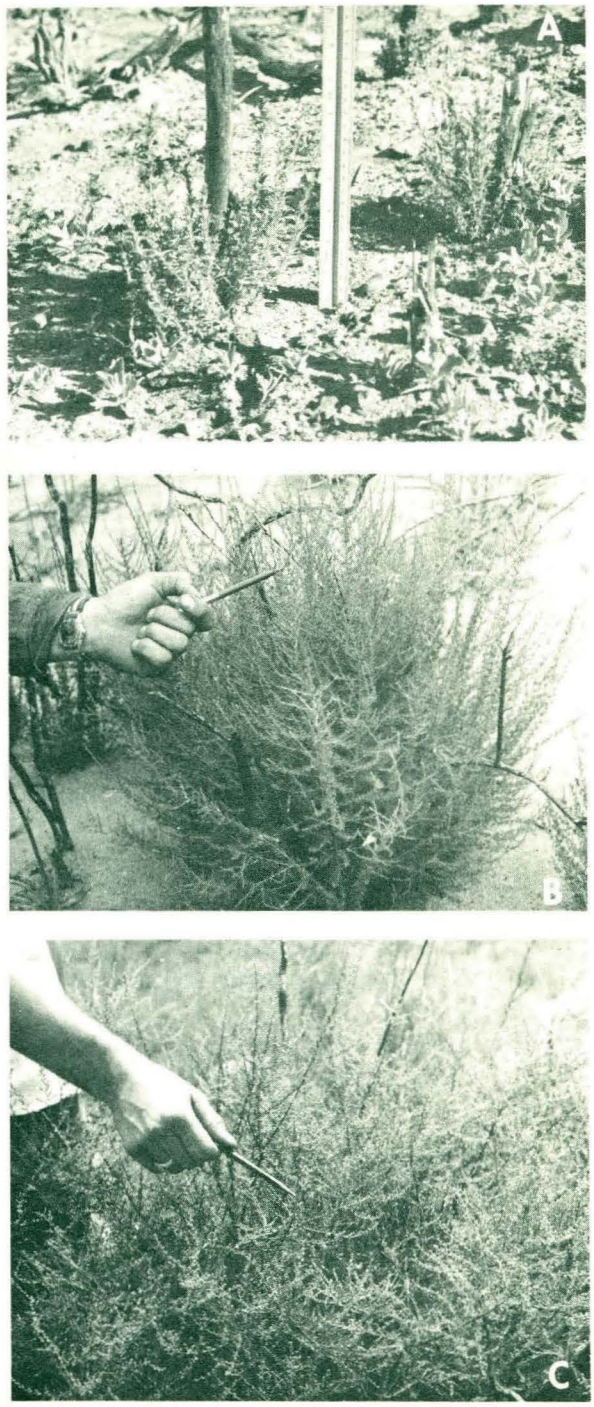

Figure 1.–*Chamise sprout development in May 1960, just before treatment:* A, *in Area I, first-season sprouts are just emerging to 6 inches, succulent, and actively growing;* B, *in Area II, second-season sprouts are 1 to 2 feet tall, with new succulent growth 2 to 6 inches long;* C, *in Area III, third-season sprouts are 2 to 4 feet tall, with much of the new growth in floral development; flowers have formed but have not opened.*

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GPO-977-750